24. (Previously presented) The process of claim 22, further comprising the steps of:

heating the reaction mixture to reflux; and

cooling the reaction mixture to room temperature.

25. (Previously presented) The process of claim 24, further comprising isolating the POSS fragment.

26. (Previously presented) The process of claim 25, wherein the POSS fragment is isolated by distillation, filtration, evaporation, decantation, crystallization, pressure reduction, or extraction, or a combination thereof.

27. (Previously presented) The process of claim 26, further comprising the step of purifying the isolated POSS fragment through washing with water.

28. (Previously presented) The process of claim 22 wherein the base cleaves at least one silicon-oxygen-silicon (Si-O-Si) bond in the polymeric silsesquioxane to promote the conversion of the polymeric silsesquioxane into the POSS fragment.

29. (Amended) The process of claim 28, wherein the base is selected from the group consisting of hydroxide $[OH]^-$, organic alkoxides $[R''O]^-$, carboxylates $[R''COO]^-$, amides $[R''NH]^-$, carboxamides $[R''C(O)NR'']^-$, carbanions $[R'']^-$ [[,]] , carbonate $[CO_3]^{-2}$, sulfate $[SO_4]^{-2}$, phosphate $[PO_4]^{-3}$, biphosphate $[HPO_4]^{-2}$, phosphorus ylides $[R''_4P]^-$, nitrate $[NO_3]^-$, borate $[B(OH)_4]^-$, cyanate $[OCN]^-$, fluoride $[F]^-$, hypochlorite $[OCl]^-$, silicate $[SiO_4]^{-4}$, stannate $[SnO_4]^{-4}$, basic metal oxides comprising Al_2O_3, CaO, and ZnO, amines R''_3N and amine oxides R''_3NO, and organometallics comprising $R''Li$, R''_2Zn, R''_2Mg, and $R''MgX'$, where R″ represents an organic substituent and multiple organic substituents need not be identical, and X′ represents an inorganic substituent.

30. (Previously presented) The process of claim 22, wherein a mixture of different bases is used.

31. (Previously presented) The process of claim 22, further comprising mixing a co-reagent with the base and the polymeric silsesquioxane in the solvent.

32. (Previously presented) The process of claim 31, wherein the co-reagent is selected from the group consisting of common Grignard reagents [[R″MgX]] R″MgX′ , alkalihalides, zinc compounds comprising ZnI_2, $ZnBr_2$, $ZnCl_2$, and ZnF_2, aluminum compounds comprising Al_2H_6, $LiAlH_4$, AlI_3, $AlBr_3$, $AlCl_3$, and AlF_3, and boron compounds comprising $R''B(OH)_2$, BI_3, BBr_3, BCl_3, and BF_3, where R″ represents an organic substituent and X′ represents an inorganic substituent.

Claims 33-45 (cancelled).

46. (Previously presented) A process of converting a plurality of POSS fragments into a POSS compound, comprising:

mixing an effective amount of a base with the plurality of POSS fragments in a solvent to produce a basic reaction mixture, the base reacting with the POSS fragments to produce the POSS compound,

wherein the POSS fragments have the formula $(RSiO_{1.5})_m(RXSiO_{1.0})_n$ and contain from 1 to 7 silicon atoms and no more than 3 rings, and the POSS compound is selected from the group consisting of homoleptic nanostructure compounds having the formula $[(RSiO_{1.5})_n]_{\Sigma\#}$, heteroleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n]_{\Sigma\#}$, functionalized homoleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(RXSiO_{1.0})_n]_{\Sigma\#}$, functionalized heteroleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n(RXSiO_{1.0})_p]_{\Sigma\#}$, and expanded POSS fragments having the formula $(RSiO_{1.5})_m(RXSiO_{1.0})_n$, where R and R' each represents an organic substituent, X represents a functionality substituent, m, n and p represent the stoichiometry of the formula, Σ

indicates nanostructure, and # represents the number of silicon atoms contained within the nanostructure.

47. (Previously presented) The process of claim 46, wherein the base and the POSS fragments are mixed by stirring the reaction mixture.

48. (Previously presented) The process of claim 46, further comprising the steps of:

heating the reaction mixture to reflux; and

cooling the reaction mixture to room temperature.

49. (Previously presented) The process of claim 48, further comprising:

isolating the POSS compound.

50. (Previously presented) The process of claim 49 wherein the POSS compound is isolated by distillation, filtration, evaporation, decantation, crystallization, pressure reduction, or extraction, or a combination thereof.

51. (Previously presented) The process of claim 50, further comprising the step of purifying the isolated POSS compound through washing with water.

52. (Previously presented) The process of claim 46, wherein the base cleaves at least one silicon-oxygen-silicon (Si-O-Si) bond in the POSS fragments to promote the conversion of the POSS fragments into the POSS compound.

53. (Previously presented) The process of claim 52, wherein the base is selected from the group consisting of hydroxide $[OH]^-$, organic alkoxides $[R''O]^-$, carboxylates $[R''COO]^-$, amides $[R''NH]^-$, carboxamides $[R''C(O)NR'']^-$, carbanions $[R'']^-$, carbonate $[CO_3]^{-2}$, sulfate $[SO_4]^{-2}$, phosphate $[PO_4]^{-3}$, biphosphate $[HPO_4]^{-2}$, phosphorus ylides $[R''_4P]^-$, nitrate $[NO_3]^-$, borate $[B(OH)_4]^-$, cyanate $[OCN]^-$, fluoride $[F]^-$, hypochlorite $[OCl]^-$, silicate $[SiO_4]^{-4}$, stannate $[SnO_4]^{-4}$, basic metal oxides comprising Al_2O_3, CaO, and ZnO, amines R''_3N and amine oxides R''_3NO,

and organometallics comprising R″Li, R''_2Zn, R''_2Mg, and R″MgX′, where R″ represents an organic substituent and multiple organic substituents need not be identical, and X′ represents an inorganic substituent.

54. (Previously presented) The process of claim 53, wherein the concentration of the base is between 1-10 equivalents per mole of silicon present in the reaction mixture.

55. (Previously presented) The process of claim 54, wherein the concentration of the hydroxide base is between 1-2 equivalents per mole of silicon present in the reaction mixture.

56. (Previously presented) The process of claim 46, wherein a mixture of different bases is used.

57. (Previously presented) The process of claim 46, further comprising mixing a co-reagent with the base and the plurality of POSS fragments in the solvent.

58. (Amended) The process of claim 47, wherein the co-reagent is selected from the group consisting of common Grignard reagents [[R″MgX]] R″MgX′, alkalihalides, zinc compounds comprising ZnI_2, $ZnBr_2$, $ZnCl_2$, and ZnF_2, aluminum compounds comprising Al_2H_6, $LiAlH_4$, AlI_3, $AlBr_3$, $AlCl_3$, and AlF_3, and boron compounds comprising $R''B(OH)_2$, BI_3, BBr_3, BCl_3, and BF_3, where R″ represents an organic substituent and X′ represents an inorganic substituent.

59. (Previously presented) A process of converting a first functionalized POSS nanostructure compound into a second functionalized POSS nanostructure compound that is different than the first functionalized POSS nanostructure compound, comprising:

mixing an effective amount of a base with the first functionalized POSS nanostructure compound in a solvent to produce a basic reaction mixture, the base reacting with the first functionalized POSS nanostructure compound to produce the second POSS nanostructure compound,

wherein the first and second POSS nanostructure compounds are each selected from the group consisting of homoleptic nanostructure compounds having the formula $[(RSiO_{1.5})_n]_{\Sigma\#}$, heteroleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n]_{\Sigma\#}$, functionalized homoleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(RXSiO_{1.0})_n]_{\Sigma\#}$, and functionalized heteroleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n(RXSiO_{1.0})_p]_{\Sigma\#}$, where R and R' each represents an organic substituent, X represents a functionality substituent, m, n and p represent the stoichiometry of the formula, Σ indicates nanostructure, and # represents the number of silicon atoms contained within the nanostructure.

60. (Previously presented) The process of claim 59, wherein the second functionalized POSS nanostructure compound has more functionalities X than the first functionalized POSS nanostructure compound but the two functionalized POSS nanostructure compounds have the same number of silicon atoms.

61. (Previously presented) The process of claim 59, wherein the base and the first functionalized POSS nanostructure compound are mixed by stirring the reaction mixture.

62. (Previously presented) The process of claim 61, further comprising the steps of:

heating the reaction mixture to reflux; and

cooling the reaction mixture to room temperature.

63. (Previously presented) The process of claim 62, further comprising:

isolating the second functionalized POSS nanostructure compound.

64. (Previously presented) The process of claim 63, wherein the second functionalized POSS nanostructure compound is isolated by distillation, filtration, evaporation, decantation, crystallization, pressure reduction, or extraction, or a combination thereof.

65. (Previously presented) The process of claim 64, further comprising the step of purifying the isolated POSS nanostructure compound through washing with water.

66. (Previously presented) The process of claim 59, wherein the base cleaves at least one silicon-oxygen-silicon (Si-O-Si) bond in the first functionalized POSS nanostructure compound to promote the conversion of the first functionalized POSS nanostructure compound into the second functionalized POSS nanostructure compound.

67. (Previously presented) The process of claim 66, wherein the base is selected from the group consisting of hydroxide $[OH]^-$, organic alkoxides $[R''O]^-$, carboxylates $[R''COO]^-$, amides $[R''NH]^-$, carboxamides $[R''C(O)NR'']^-$, carbanions $[R'']^-$, carbonate $[CO_3]^{-2}$, sulfate $[SO_4]^{-2}$, phosphate $[PO_4]^{-3}$, biphosphate $[HPO_4]^{-2}$, phosphorus ylides $[R''_4P]^-$, nitrate $[NO_3]^-$, borate $[B(OH)_4]^-$, cyanate $[OCN]^-$, fluoride $[F]^-$, hypochlorite $[OCl]^-$, silicate $[SiO_4]^{-4}$, stannate $[SnO_4]^{-4}$, basic metal oxides comprising Al_2O_3, CaO, and ZnO, amines R''_3N and amine oxides R''_3NO, and organometallics comprising $R''Li$, R''_2Zn, R''_2Mg, and $R''MgX'$, where R″ represents an organic substituent and multiple organic substituents need not be identical, and X′ represents an inorganic substituent.

70. (Previously presented) The process of claim 59, wherein a mixture of different bases is used.

71. (Previously presented) The process of claim 59, further comprising mixing a co-reagent with the base and the first functionalized POSS nanostructure compound in the solvent.

72. (Amended) The process of claim 71, wherein the co-reagent is selected from the group consisting of common Grignard reagents [[R″MgX]] R″MgX′, alkalihalides, zinc compounds comprising ZnI_2, $ZnBr_2$, $ZnCl_2$, and ZnF_2, aluminum compounds comprising Al_2H_6, $LiAlH_4$, AlI_3, $AlBr_3$, $AlCl_3$, and AlF_3, and boron compounds comprising $R''B(OH)_2$, BI_3, BBr_3, BCl_3, and BF_3, where R″ represents an organic substituent and X′ represents an inorganic substituent.

Claims 73-85 (cancelled).

86. (Previously presented) A process of converting an unfunctionalized POSS nanostructure compound into a functionalized POSS nanostructure compound, comprising:

mixing an effective amount of a base with the unfunctionalized POSS nanostructure compound in a solvent to produce a basic reaction mixture, the base reacting with the unfunctionalized POSS nanostructure compound to produce the functionalized POSS nanostructure compound,

wherein the unfunctionalized POSS nanostructure compound is selected from the group consisting of homoleptic nanostructure compounds having the formula $[(RSiO_{1.5})_n]_{\Sigma\#}$ and heteroleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n]_{\Sigma\#}$, and the functionalized POSS nanostructure compound is selected from the group consisting of functionalized homoleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(RXSiO_{1.0})_n]_{\Sigma\#}$ and functionalized heteroleptic nanostructure compounds having the formula $[(RSiO_{1.5})_m(R'SiO_{1.5})_n(RXSiO_{1.0})_p]_{\Sigma\#}$, where R and R' each represents an organic substituent, X represents a functionality substituent, m, n and p represent the stoichiometry of the formula, Σ indicates nanostructure, and # represents the number of silicon atoms contained within the nanostructure.

87. (Previously presented) The process of claim 86, wherein the base and the unfunctionalized POSS nanostructure compound are mixed by stirring the reaction mixture.

88. (Previously presented) The process of claim 86, further comprising the steps of:

heating the reaction mixture to reflux; and

cooling the reaction mixture to room temperature.

89. (Previously presented) The process of claim 88, further comprising:

isolating the functionalized POSS nanostructure compound.

90. (Previously presented) The process of claim 89, wherein the functionalized POSS nanostructure compound is isolated by distillation, filtration, evaporation, decantation, crystallization, pressure reduction, or extraction, or a combination thereof.

91. (Previously presented) The process of claim 90, further comprising the step of purifying the isolated functionalized POSS nanostructure compound through washing with water.

92. (Previously presented) The process of claim 86, wherein the base cleaves at least one silicon-oxygen-silicon (Si-O-Si) bond in the unfunctionalized POSS nanostructure compound to promote the conversion of the polymeric silsesquioxane into the functionalized POSS nanostructure compound.

93. (Amended) The process of claim 92, wherein the base is selected from the group consisting of hydroxide $[OH]^-$, organic alkoxides $[R''O]^-$, carboxylates $[R''COO]^-$, amides $[R''NH]^-$, carboxamides $[R''C(O)NR'']^-$, carbanions $[R'']^-$ [[,]] , carbonate $[CO_3]^{-2}$, sulfate $[SO_4]^{-2}$, phosphate $[PO_4]^{-3}$, biphosphate $[HPO_4]^{-2}$, phosphorus ylides $[R''_4P]^-$, nitrate $[NO_3]^-$, borate $[B(OH)_4]^-$, cyanate $[OCN]^-$, fluoride $[F]^-$, hypochlorite $[OCl]^-$, silicate $[SiO_4]^{-4}$, stannate $[SnO_4]^{-4}$, basic metal oxides comprising Al_2O_3, CaO, and ZnO, amines R''_3N and amine oxides R''_3NO, and organometallics comprising R″Li, R''_2Zn, R''_2Mg, and R″MgX′, where R″ represents an organic substituent and multiple organic substituents need not be identical, and X′ represents an inorganic substituent.

94. (Previously presented) The process of claim 93, wherein the base is a hydroxide and the concentration of the hydroxide base is between 1-10 equivalents per mole of silicon present in the reaction mixture.

95. (Previously presented) The process of claim 94, wherein the concentration of the hydroxide base is between 2-5 equivalents per mole of silicon present in the reaction mixture.

96. (Previously presented) The process of claim 95, wherein a mixture of different bases is used.

97. (Previously presented) The process of claim 86, further comprising mixing a co-reagent with the base and the unfunctionalized POSS nanostructure compound in the solvent.

98. (Amended) The process of claim 97, wherein the co-reagent is selected from the group consisting of common Grignard reagents [[R"MgX]] R"MgX', alkalihalides, zinc compounds comprising ZnI_2, $ZnBr_2$, $ZnCl_2$, and ZnF_2, aluminum compounds comprising Al_2H_6, $LiAlH_4$, AlI_3, $AlBr_3$, $AlCl_3$, and AlF_3, and boron compounds comprising $R''B(OH)_2$, BI_3, BBr_3, BCl_3, and BF_3, where R" represents an organic substituent and X' represents an inorganic substituent.

Claims 99-113 (cancelled).

114. (Amended) A process of converting a polymeric silsesquioxane into a POSS nanostructure compound, comprising:

mixing an effective amount of a base with the polymeric silsesquioxane in a solvent to produce a basic reaction mixture, the base reacting with the polymeric silsesquioxane to produce the POSS nanostructure compound,

wherein the polymeric silsesquioxane has the formula $[RSiO_{1.5}]_{\infty}$, and the POSS nanostructure compound is $[(RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$, where R represents an organic substituent, X represents a functionality substituent, ∞ represents the degree of polymerization and is a number greater than or equal to 1, ~~m, n and p represent the stoichiometry of the formula,~~ and Σ indicates nanostructure. ~~, and # represents the number of silicon atoms contained within the nanostructure .~~

115. (Previously presented) The process of claim 46, wherein the POSS compound is $[RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$.

116. (Previously presented) The process of claim 59, wherein the second functionalized POSS nanostructure compound is $[(RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$.

Claim 117 (cancelled).

118 (Previously presented) The process of claim 86, wherein the functionalized POSS nanostructure compound is $[(RSiO_{1.5})_4(RXSiO_{1.0})_3]_{\Sigma 7}$.

Claims 119-134 (cancelled).